24.

t	y
3 hr	10,000
5 hr	40,000
0 hr	? y_0

2 <

$$y = y_0 e^{kt}$$

$$10{,}000 = y_0 e^{k \cdot 3}$$

$$40{,}000 = y_0 e^{k \cdot 5}$$

$$40{,}000 = 10{,}000\, e^{k \cdot 2}$$

$$\rightarrow 4 = e^{2k}$$

$$\frac{\ln 4}{2} = \cancel{2}k$$

$$\frac{10{,}000}{\left(e^{\frac{\ln 4}{2} \cdot 3}\right)} = y_0 \cancel{\left(e^{\frac{\ln 4}{2} \cdot 3}\right)}$$

$$8 = e^{\left(\frac{\ln 4}{2} \cdot 3\right)}$$

$$\left(e^{\ln 4}\right)^{\frac{3}{2}}$$

$$y = 1250$$

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44.

100% comp. continuously

$r \doteq 1$

a) $y = y_0 e^{t}$

b) $3y_0 = y_0 e^{t}$

$3 = e^{t}$

$\ln 3 = t$

$t = 1.09$

$$dt = \frac{\ln 2}{k}$$

c) $y = y_0 \cdot e$

$y = 2.718\, y_0$

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a) $\frac{\ln 90}{k} = 100$

$k = \frac{\ln 90}{100} = .0449 \approx 4.5\%$

b) $\frac{\ln 131}{100} = .04875 \approx 4.9\%$

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$dt = \frac{\ln 2}{k} = \frac{.69}{r} = \frac{69}{r\%} \approx \frac{70}{r} \approx \frac{72}{r}$

$k = \frac{\ln 2}{dt} = \frac{70}{dt} = \frac{72}{dt}$

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6.4 b Newton's law of cooling

solve the de

$$\frac{dT}{dt} = -k(T - T_s)$$

describe with a sentence

T = Temp of liquid

T_s = Temp of surroundings

t = time

k = cooling constant

the hotter the liquid, the. faster it cools

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solve

$$\frac{dT}{dt} = -k(T - T_s)$$

$$\int \frac{dT}{T - T_s} = \int -k\,dt$$

sep. of var.

$$\ln|T - T_s| = (-kt + c)$$

e e

$$|T - T_s| = e^{-kt} \cdot e^{c}$$

ok to drop abs because $T-T_s$ pos

$$T - T_s = c\, e^{-kt}$$

initial cond
$t=0$ $T=T_0$

$$T_0 - T_s = c\, e^{0}$$

$$T - T_s = (T_0 - T_s)e^{-kt}$$

newton's law of cooling

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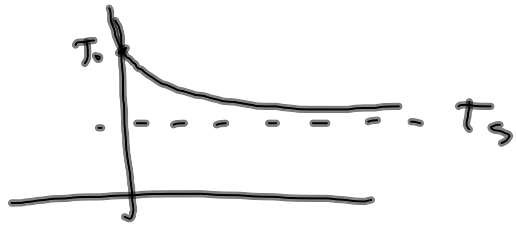
$$T = T_s + (T_0 - T_s)\, e^{-kt}$$



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Ex 6 $\quad T_0 = 98 \quad T_s = 18^{\circ}$

$t = 5 \quad T = 38 \quad$ use to find k

$t = ? \quad T = 20$

$$38 = 18 + (98 - 18)\, e^{-k \cdot 5}$$

ln, ln4 $\quad \dfrac{20}{80} = e^{-5k}$

$$\frac{-\ln 4}{-5} = \frac{\ln \frac{1}{4}}{-5} = \cancel{-5}k \qquad k = \frac{\ln 4}{5}$$

$$20 = 18 + (98 - 18)\, e^{-\frac{\ln 4}{5} t}$$

solve for t $\quad \dfrac{2}{80} = e^{-\frac{\ln 4}{5} t}$

$$\frac{5 \ln \frac{1}{40}}{-\ln 4} = \cancel{-\frac{\ln 4}{5}}\, t$$

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radioactive decay

$y = y_0 e^{-kt}$ have to find k

give half life

$y = y_0 \left(\frac{1}{2}\right)^{\frac{t}{H}}$

$H = \frac{\ln 2}{k}$ $k = \frac{\ln 2}{H}$

$C_{14} = 5700$ yrs

10% of C_{14} decayed

90% remains

$.90\,y_0 = y_0 \left(\frac{1}{2}\right)^{\frac{t}{5700}}$

EX5